

OBSERVATIONS ON *ANOPHELES (CELLIA) ACONITUS* DONITZ, 1902 (DIPTERA: CULICIDAE) IN BASTAR DISTRICT, MADHYA PRADESH¹

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(With four text-figures)

A total of 117 specimens of *Anopheles aconitus* were taken in 18 villages of Bastar District, Madhya Pradesh out of 105 surveyed in 1206 man/hours. This mosquito was mainly distributed in forests of Hot-Wet climatic belt found between 304 and over 761 m (a.s. l.). This species appeared to be an exophilic species. The feeding was generally completed before midnight. The greatest numerical abundance was found in the Hot-Wet region in October and November. This *Anopheles* was not captured from human bait nor any anthropophilic index detected.

INTRODUCTION

Anopheles aconitus has a wide range in South East Asia stretching from Central and Eastern India, to Vietnam, Sulawesi and Timor (Soerono *et al.* 1965). This species has not been recorded from the Philippine Islands (Ramos and Darsie 1970 and Baisas 1974) and from Afghanistan (Puri 1960). Christophers (1933) pointed that the species *Anopheles aconitus*, a component of the oriental element, has a wide distribution in the oriental region to the east and extends into the Indian area upto northwest frontier or nearly so.

There is practically no area in India where *Anopheles aconitus* is known as a vector however the species is the main vector of malaria in Indonesia and Indo China (Pal and Sharma 1955).



Fig. 1. Map of Bastar District showing physiographic divisions and distribution of *A. aconitus*. (For locality serials please refer text).

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Vaid & Nagendra (1964) reported malaria as hyper-endemic in Bastar District and *Anopheles culicifacies* Giles, 1901 and *Anopheles fluviatilis* James, 1902 were considered as the primary vectors of malaria. The present observations were made to study the bionomics of the anopheline fauna of Bastar District since information on this aspect from Madhya Pradesh was not available. Earlier Prakash & Husainy (1974) discussed the distribution pattern of the anopheline mosquitoes of Bastar District. In this paper some aspects of the bionomics of *Anopheles aconitus* are described.

AREA AND CLIMATE

The Bastar District lies in the southeast corner of Madhya Pradesh and extends from 17°46' to 20°34'N latitude and from 80°15' to 82°1' E longitude. It has an area of 39,086 sq km which falls into five main physiographical divisions (Fig. 1).

The altitude ranges from 48.5 m (village Konta) above sea level (a.s.l.) to about 1275.5 m (village Bailadila) a.s.l. This district shares the monsoon type of climate with the general Indian landmass, although the diversity of its topography does not encourage a uniform climate. There are three distinct temperature divisions namely, 22 to 24°C, 24 to 27°C and 27 to 29°C. The period from June to October covers the general rainy season. There may be two annual rainfall seasons of 152 to 178 cm and 127 to 152 cm. With the three temperature and two rainfall divisions, the district is divisible into five climatic regions (Fig. 2) (Agarwal 1968).

MATERIALS AND METHODS

General and routine collections were made during night and day inside houses, cattlesheds and outdoor vegetation of selected villages. In order to determine feeding times and the den-

sity buildup, all night collections were made between 1800 and 0600 hr at intervals of two hours for half an hour each. The mosquitoes were collected by an aspirator and torch light and were identified at the end of collection

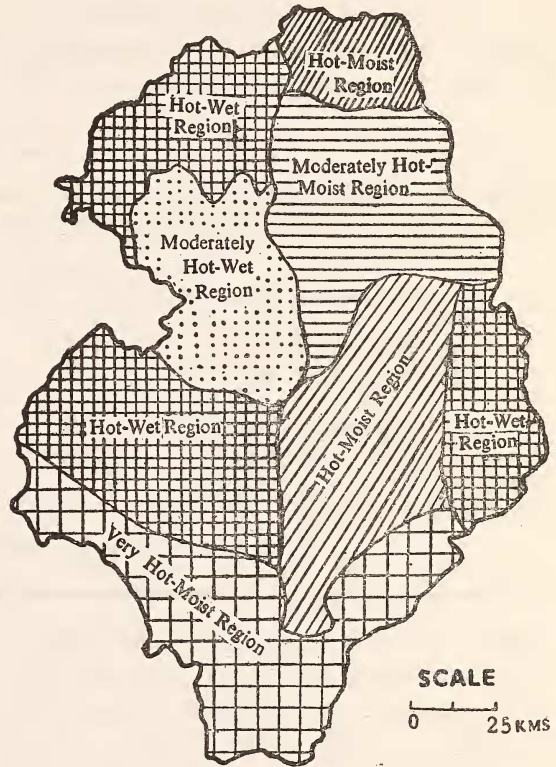


Fig. 2. Map of Bastar District showing climate regions.

on the spot in bright petromax light and their species and abdominal conditions were noted. Collections were also made by the pyrethrum spray technique inside houses to detect the indoor resting *Anopheles*. Man-biting rates were determined by placing a man as a bait and another collecting the mosquitoes actually feeding on the bait. The degree of anthropophilism/zoophilism was determined by precipi-

tin tests. The females were dissected to determine parity status and sporozoite infection.

OBSERVATIONS

The studies were carried out from August, 1969 to January, 1975. In this period a total of 21,716 specimens representing 19 species of *Anopheles* were captured in 1206 man/hours which had 117 specimens (25 unfed, 91 fed

tudinal distribution ranges from 304 to over 761 m. It has been secured from Hot-Wet, Moderately Hot-Moist and Hot-Moist climatic regions of the district.

Diurnal Resting Places: *Anopheles aconitus* was not found during day time in house or cattlesheds. A total of 111 specimens (94.8%) were taken from cattlesheds in the night (Table 1).

TABLE 1

COMPOSITION OF *Anopheles aconitus* CAPTURED AT VARIOUS SITES IN BASTAR DISTRICT, MADHYA PRADESH

No.	Habitat	Man/Hours Spent	Nos. Collected		Per cent
			Male	Female	
1.	Cattlesheds:				
	A. From 0500 to 1800 hrs	144	0	0	—
	B. From 1800 to 0500 hrs	702	0	111	94.8
2.	Houses:				
	A. From 0500 to 1800 hrs	139	0	0	—
	B. From 1800 to 0500 hrs	117	0	0	—
3.	Outdoors:				
	From 0600 to 1800 hrs	104	1	5	5.2
Total		1206	1	116	

females, 1 male) of *Anopheles aconitus* secured from 18 villages out of 105 surveyed (Fig. 1). The numbers of specimens taken from each village is given within brackets, while the name of each village is preceded by a numeral which marks its location on the map.

Specimens Collected: 1. Asna (1); 2. Aghanpur (9); 3. Adhawal (11); 4. Hat Kachora (12); 5. Kurandi (2); 6. Barsoor (2); 7. Chote Dongar (5); 8. Paknar (1); 9. Kotamsar (18); 10. Tirathgarh (3); 11. Mamadpal (6); 12. Bispur (1); 13. Kamanar (10); 14. Kukalgur (2); 15. Darbha (21); 16. Burdum (1); 17. Tuswal (5); 18. Tongpal (7). Total = 117.

Distribution: The species was recorded from Abujh Marh Hills, North-Eastern Plateau, Indravati Plains and Southern Plateau. The alti-

Specimens in full gravid/partgravid state were never captured indoors. Out of doors, one male and five fed females (5.2 per cent) were encountered in village Adhawal in the fences alongside ricefields. It appears to be an exophilic species in Bastar District.

Feeding time of adult female: Between October, 1969 and September, 1971 a total of 147 routine all night catches were made which fetched 45 freshly fed females of *Anopheles aconitus* resting in cattlesheds of the study villages at different hours of night collection. The biting cycles (Fig. 4) are prepared from the combined data for each hour from collections in all seasons. It was seen that *Anopheles aconitus* generally completed feeding before midnight. In November, this mosquito was

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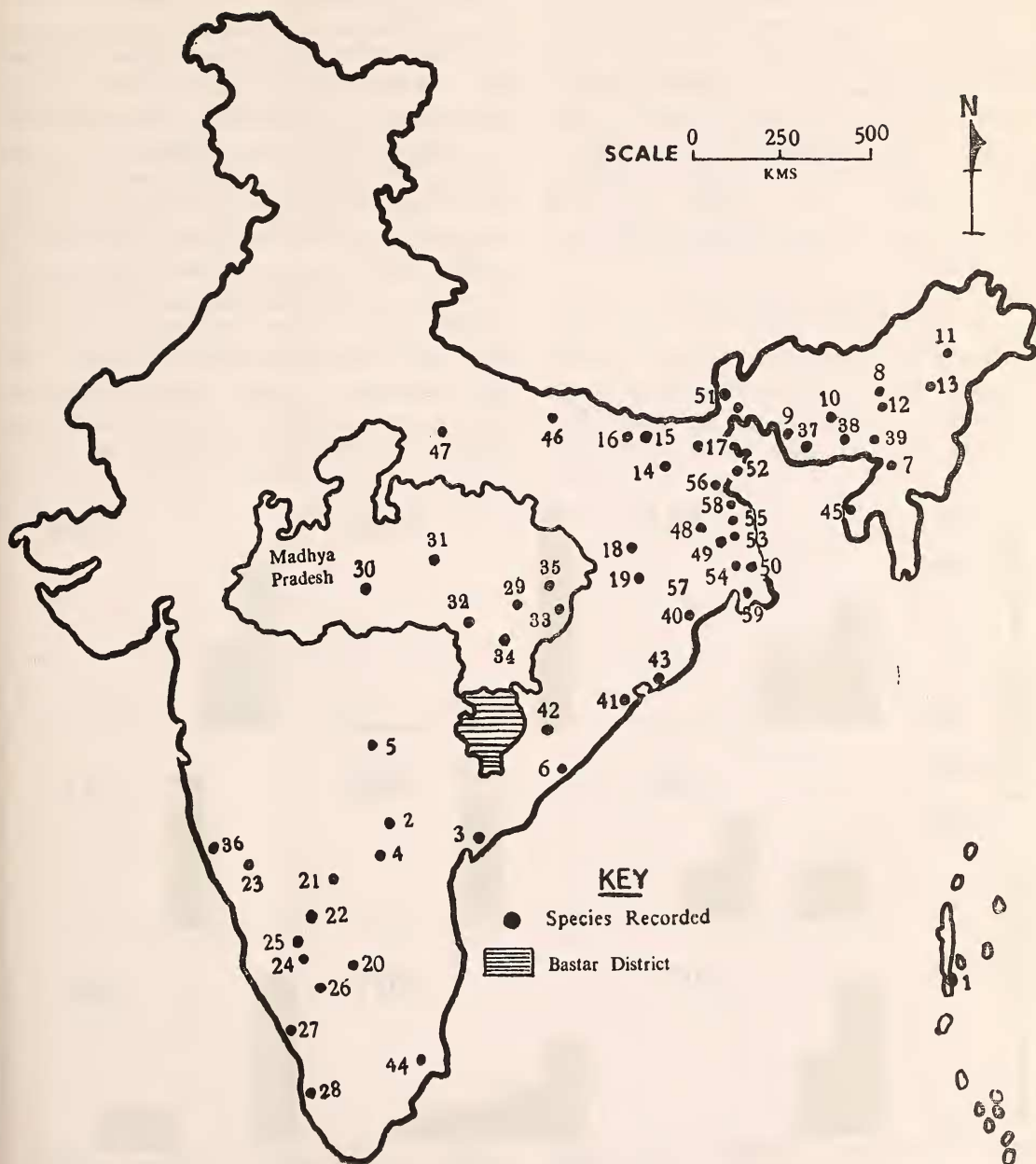


Fig. 3. Map of India showing distribution of *A. aconitus*.
(For locality serials please refer text).

most active between 1800 and 2000 hr and the numbers caught declined progressively through the night. In July and December slight activities were noted beyond midnight also.

Density Build Up: It was not regularly taken in village Darbha between October, 1969 and September, 1970. Out of a total of eight examples captured in this period, seven were found in October while a solitary female was taken in June.

Seasonal Prevalence: The majority of specimens of *Anopheles aconitus* (76) were taken in October and November. In other months the species was less numerous while in the peak of winter (January) and summer (May) this species was not encountered (Table 2).

Area of Abundance: The majority of the villages positive for the species are located in the Indravati Plains, 457 to 609 m elevation and Hot-Wet climatic region. Table 3 shows the collection of *Anopheles aconitus* in different climatic belts of the district. It will be seen that 70 examples (59.8%) were taken in the Hot-Wet Region. This area is mostly covered with forest. In Hot-Moist region 36 examples (34%) were captured. This belt receives less rainfall than the Hot-Wet. In Moderately Hot-Wet and Moderately Hot-Moist Regions, which are coolest areas of the district, *Anopheles aconitus* was less numerous, while in the Very Hot-Moist Region where least rainfall and highest temperatures of the district

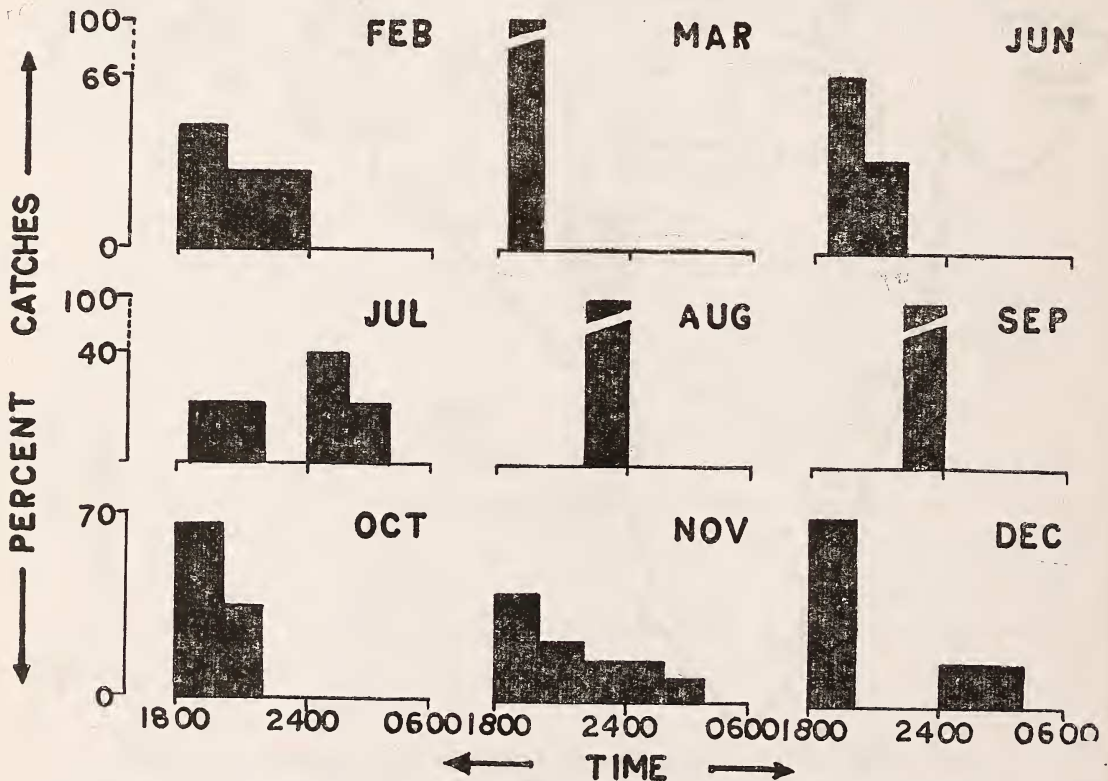


Fig. 4. Feeding times of *A. aconitus* female adults in Bastar District, Madhya Pradesh.

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are recorded, this anopheline was not captured.

Man Biting Rate: No female of *Anopheles aconitus* was found biting human bait in the houses of three villages where man biting rates were determined for 80 man/hours although 67 anopheline females belonging to five species were captured along with 263 culicine females.

Anthrophilic Index: A total of 14 smears of the gut contents proved to be zoophilic in the precipitin test. These females were captured in the cattlesheds of three villages Tongpal, Darbha and Kukalgur.

Dissections: A total of 102 females which were dissected, had 81 nulliparous females indicating their fresh arrivals for feeding. The remainder (21) were found one parous proving the age of those females of less than a week. Sporozoite of *Plasmodium* spp. were not found in the salivary glands of any female dissected.

TABLE 2

SEASONAL PREVALENCE OF *Anopheles aconitus* AT THREE PLACES IN INDIA

No. Month	Numbers taken at			
	Bastar District*		Nilgiris District**	Puri, Orissa***
	Actuals	Per man Hour	Per man Hour	Actuals
1. January	00	—	—	75
2. February	07	0.2	—	47
3. March	04	0.1	—	10
4. April	07	0.2	—	1
5. May	00	—	—	8
6. June	05	0.2	0.1	1
7. July	05	0.2	—	1
8. August	06	0.2	—	17
9. September	04	0.1	0.1	8
10. October	23	0.8	—	21
11. November	53	1.5	0.1	131
12. December	03	0.1	0.1	100
Total	117			420

* Present studies. ** Russell and Jacob (1942).

*** Panigrahi (1942).

TABLE 3

COMPOSITION OF *Anopheles aconitus* COLLECTED IN VARIOUS CLIMATIC BELTS OF BASTAR DISTRICT, MADHYA PRADESH

No.	Climatic Region	No. collected	Per cent
1.	Moderately Hot-Moist Region	5	5.6
2.	Moderately Hot-Wet Region	6	5.6
3.	Hot-Wet Region	70	59.8
4.	Hot-Moist Region	36	29
5.	Very Hot-Moist Region	0	—

DISCUSSION

The distribution of the oriental element *Anopheles aconitus* was noted in forest area at higher altitudes of the district. In plain areas, it was not encountered. It is not a widely distributed and numerically dominant species in the district. Russell & Jacob (1942) secured *Anopheles aconitus* larvae upto 1219 m (a.s.l.) in Nilgiris District, India. The present distribution of this species in India is shown in Fig. 3 (Puri 1955). The mosquito appeared to visit cattlesheds in the night while diurnally it took asylum out of doors. Büttiker (1958) described this behaviour as a complete deliberate type "A" exophily (Endophagy of Senior White). Muirhead-Thomson (1963) noted in the inland areas of Java that very few specimens of *Anopheles aconitus* rested during day time in houses and very few are secured in the usual type of cattleshed which has a roof but no walls, and a great majority of *Anopheles aconitus* are found outdoors in the banks of streams and other sheltered places at densities much higher than in houses, and about 23% of these outdoor resting females are found to be freshly fed. Russell & Jacob (1942) took one female each in houses and mixed dwellings and two females in cattlesheds of Nilgiris west from February, 1940 to January, 1941. Pal & Sharma (1955) stated that adult fe-

males of *Anopheles aconitus* as a rule, feed and rest indoors.

Though feeding times in individual months varied however this was generally completed before midnight. This *Anopheles* was taken all round the year except during the peak of winter and summer. It appears that peaks of rain and extreme temperatures, both low and high, discourage the numerical abundance of *Anopheles aconitus*. The main period of abundance may be considered in early winter after the rains have stopped. Russell & Jacob (1942) while working in Nilgiris west, recorded this species in equal numbers in June, September, November and December. Panigrahi (1942) reported the prevalence of *Anopheles aconitus* in Puri, Orissa, throughout the year with peak densities in November after which it declined. This mosquito was not numerically dominant in the anopheline fauna, for its 117 specimens captured formed only 1.9% of the total collection (21,716 specimens) of the district. Panigrahi (1942) took 45,123 examples of anopheline mosquitoes in Puri, Orissa, which had 420 specimens of *Anopheles aconitus* (0.9% of total).

No anthropophilic index was detected in *Anopheles aconitus* nor was it taken from human bait. Pal & Sharma (1955) pointed out that the females readily feed on man. In Java, biting takes place indoors and outdoors and can reach extremely high levels if the human bait is in the vicinity of cattle (especially water buffalo) (Soerono *et al.* 1965). Anthropophilic indices of 11.2% (caught from houses) and 0.5% (caught from stables) have been recorded from Indo-China and 12% (cattle present) and 61% (cattle scarce) from Indonesia (Pal & Sharma 1955). Sporozoite infection was not found in salivary glands of females dissected. None of the earlier records suspects this *Anopheles* as a vector of malaria in India although Senior White *et al.* (1943) found sporozoite infection in the salivary glands of two female adults of this species out of 951 from Coastal Orissa, dissected.

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